LET THEM EAT CAKE

You can have your cake and eat bread, too!

A cookie-baking test reveals whether wheat has the desired characteristics to make tender pastry products. Here, food technologist Ron Martin (left) removes test cookies from the oven while food technologist Charles Gaines measures two cookies.

You can have your cake and eat bread, too—as long as you start with the right kind of wheat.

ARS scientists at the Soft Wheat Quality Research Unit in Wooster, Ohio, have found that some modern U.S. eastern soft wheats have enough dough-mixing strength to make bread, while still making fine baked goods.

They have found this with a new quick test for the gluten, or protein strength, that gives dough its mixing strength. The new test, called the lactic acid solvent retention capacity test, is actually a refinement of one developed at the Wooster lab in the 1940s. In fact, K.F. Finney, the father of ARS food technologist Patrick L. Finney, developed the original test. The latter Finney is at the Wooster lab.

Traditionally, plant breeders have believed that pastry- and bread-making qualities in wheat were in conflict. So, in the 1940s, they rejected soft wheats having a high protein strength—a trait associated with hard wheats.

Soft wheats are used to make pastries, cookies, crackers, and flat or hearth breads, such as pita bread. Hard wheats are used to make the everyday loaves of bread Americans are so familiar with.

While breeders no longer reject soft wheats with strong protein content, they don't breed for it either. The results are therefore mixed. The proportion of soft wheat varieties that have strong protein content rose from about 10 percent in 1944 to 60 percent in 1984 and now stands at around 25 percent.

The wheat industry recently recognized that it could create a potentially valuable new subclass of soft wheat with strong protein content—what Finney calls "multifunction soft wheat." Nabisco, Inc., went back to the ARS test for protein strength in soft wheat and refined it. The refined test is now in use.

One reason Nabisco and other manufacturers want the test is to make saltine crackers with all soft wheat. Currently, saltine manufacturers have to mix in some hard wheat flour for its high protein strength. If manufacturers could use only soft wheat flour with high protein strength, they could save money because hard wheat costs more.

It is the low cost of U.S. soft wheat that causes other countries, particularly those in the Mideast, to rely on it for their pita and other flat breads. But industry came to realize that these customers also like the performance of the U.S. eastern soft wheat more than they like hard wheat or soft wheats from other countries. In fact, the U.S. eastern

soft wheat performs better than some higher priced French bread wheats.

So Finney and his colleague, Charles S. Gaines, an ARS food technologist who heads the Wooster unit, decided that it would pay in the long run to give these customers more of what they like—a stronger protein that gives the bread the taste and texture they favor.

"We don't want to make the same mistake that U.S. automakers made decades ago, in taking the market for granted. We have to take the initiative in finding ways to better satisfy our customers, or some day they may buy from other countries," Finney says.

Got Gluten?

"We're adding value to domestic and export markets in one stroke," says Gaines. "The stronger gluten content will make better crackers for the United States and better hearth breads for the Middle East. We can only hope that buyers pay a premium price for this new wheat and that farmers get their share—two big ifs," Gaines says.

The newly adapted test for soft wheat gluten strength replaces the standard Mixograph test. In the lactic acid test, flour samples are placed in 24 test tubes held in an automatic centrifuge. A 5-percent lactic acid/water solution is mixed with the flour, and then the tubes are centrifuged. Some of the water is absorbed by the flour; the rest is centrifuged out.

The samples are then weighed. The heaviest samples, those swollen with the most water, are the strongest gluten wheats.

Flour strength refers to its ability to be stirred or mixed with water and the resistance the dough has to mixing. Hard wheat flour is the hardest to mix, and that's the result of higher gluten strength. Also, when hard wheats are milled, the starch granules in the kernels often break open. The starch then absorbs more water during mixing and is exposed to yeast more rapidly. This is desired by the U.S. bread industry because most of their breads are leavened by yeast. Soft wheats break more irregularly, usually missing the starch granules, leaving them intact and causing lower water absorption.

The lactic acid test can assess 100 soft wheat samples an hour, compared to 4 for the Mixograph. As the name implies, the Mixograph stirs wheat and water together and draws a graph showing the resistance to mixing over the duration of the test. Wheats with strong gluten content will have broad bands of high spikes on the graph. In wheats with less gluten content, the bands narrow down quickly as the wheat relaxes its resistance.

Each year, the ARS lab receives about 6,000 samples of new soft wheat lines that are in the early stages of development. The samples are small because not enough seed has been produced at this early stage.

It is with these samples that the Soft Wheat Quality Laboratory conducts the new test based on the elder Finney's original test.

The Proof's in the Baking

When the wheat varieties are further along—about 3 years into development—there are enough wheat kernels to do the "Big Cookie" test. The Wooster researchers use the flour samples in a standard cookie recipe and bake them in laboratory ovens. The bigger the cookie—the more it spreads—the softer the wheat.

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This test remains the industry's final standard of wheat softness. Only those microsamples of new flours that have traditional softness and show high protein strength in the lactic acid test will ever survive long enough to be baked into a cookie at the Wooster lab—or anywhere else, for that matter.

The Wooster lab is constantly searching for new soft wheats because new wheat varieties often have a maximum field life of only about 5 to 7 years. Bugs and fungi don't recognize new wheat as food right away. But by the 7th year—and often sooner—their appetite for the once-new wheat can be so well developed that it lowers crop yields to the point that it's not worth growing.—By **Don Comis,** ARS.

This research is part of Plant, Microbial, and Insect Genetic Resources, Genomics, and Genetic Improvement, an ARS National Program (#301) described on the World Wide Web at http://www.nps.ars.usda.gov.

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